THE PROGRAM AND THE PAYOFFS

Research aimed at controlling the nuclear fusion process has been under way since the 1950s. In the course of a broad program focused on understanding the fusion process and applying the results to the development of power-producing reactors, fusion researchers have made significant contributions to basic scientific understanding and to high-technology development. Some of their more significant contributions are identified in this document.

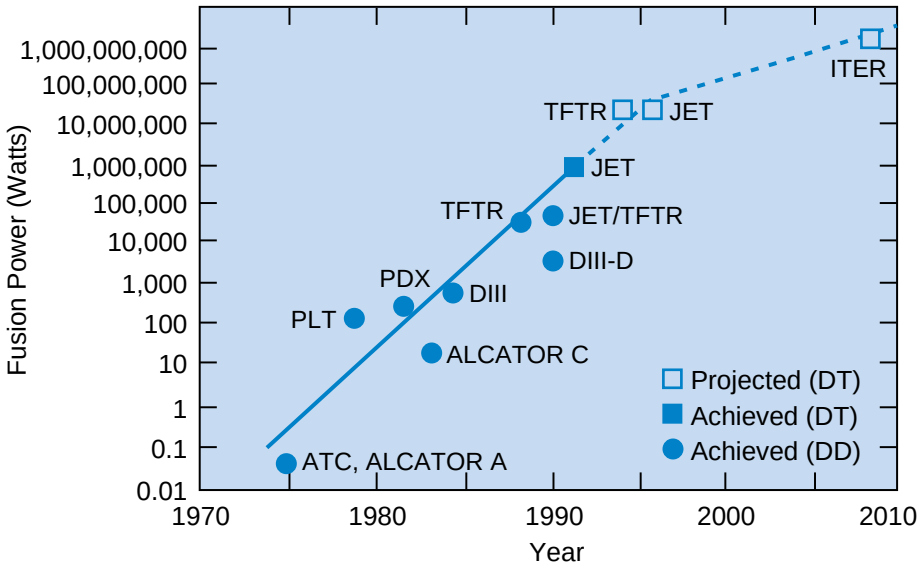
Fusion research in the United States began in 1951, when the U.S. Atomic Energy Commission estab lished a secret program called Project Sherwood to investigate the feasibility of using a controlled fusion reaction to generate power. Magnetic fusion research was declassified in 1958, and scientists throughout the world began sharing the results of their work.

Steady advances toward the goal of useful fusion power have been produced through a broadly collabo -rative program that draws on the resources of research laboratories, industry, and universities in the United States and throughout the world.

The U.S. magnetic fusion pro gram is overseen by the Office of Fusion Energy in the Department of Energy's Office of Energy Research. With an annual budget of more than $300 million, the program focuses on developing the theoretical, experimental, and technological base for a fusion energy source.

This program is also producing benefits in other areas. Innovative solutions to issues that must be addressed in the process of making fusion power a reality are being extended to related areas of science and technology, producing unexpected dividends.

Advances In Fusion Power



JET	Joint European Torus
ITER	International Thermonuclear Experimental Reactor
DIII & DIII-D	General Atomics
ATC, PLT, PDX, & TFTR	Princeton Plasma Physics Laboratory
ALCATOR A, C	Massachusetts Institute of Technology

Why is the magnetic fusion pro gram, with its seemingly esoteric aim of confining very hot matter within magnetic fields, already a rich source of valuable spin-offs, years before it is expected to reach its primary goal?

The answer to this question can be found by considering the scope and aims of the magnetic fusion research program. Fusion scientists are dealing directly with the same fundamental force of nature—electromagnetism—that has given rise to applications such as electric power, wireless communications, and electronics.

Fusion scientists deal with very energetic matter in the presence of strong electromagnetic fields. They investigate the collective behavior of charged particles in electric and magnetic fields. This field of study is called plasma physics, and its fundamental principles can be applied to subjects ranging from the behavior of stars to microwave cooking.

Fusion researchers integrate the theory and models developed through studies of plasma physics with technology development in high-power heating and fueling sys tems, superconducting magnets, and advanced materials to design and operate fusion experiments. Many of these technologies deal with phe nomena that are applicable to areas that lie beyond fusion.